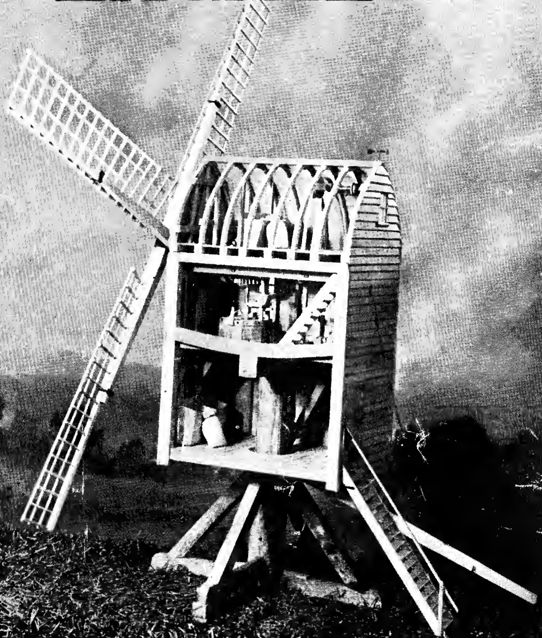
# THE MODEL ENGINEER



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# The MODEL ENGINEER

*PERCIVAL MARSHALL & CO. LTD., 23, GREAT QUEEN ST., LONDON, W.C.2*

2ND DECEMBER 1948 VOL. 99 NO. 2480



# SMOKE RINGS

### Our Cover Picture

● THE MODEL shown on our cover this week is representative of the oldest and smallest type of windmill. It was built by Mr. T. H. Coles, of Banbury, using untreated oak which he states gives a particularly pleasing effect to the weather-boards, ladders and sails. True to practice in the older mills, only one pair of stones is fitted.

Mr. Coles describes his model as being made in four sections, the lower one comprising the trestle, with 2-in. sq. post and dwarf brick pillars. Above this is the body of the mill complete with two floors, one window, halved door and frame-work for wind shaft. The weatherboarding has been omitted from one side in order that the interior and its contents may be seen. Above this section comes the roof and loft having one window, and fitted with corn bins, sack hoist and belt-tensioning device which allows the sacks to be deposited on the trap-doors, after having passed through. Here, too, weatherboarding has been omitted from one side. The fourth section comprises the stocks, $\frac{7}{8}$ in. sq. in the centre, fitted with sails. Mr. Coles states that he is indebted to Mr. Blinkhorns who photographed his model.—P.D.

### A Timely Correction

● THE TECHNICAL journals have been giving due prominence to the inauguration of the new locomotive testing plant at Rugby; but I was astonished to read in one journal a reference to the Swindon testing plant, and a statement to the effect that the maximum power absorption of this plant is 500 h.p. Some of the older members of the S.M.E.E. may remember an occasion when a party of members enjoyed the spectacle of a locomotive being put through its paces on that plant. The final sensation was given when, after the party had witnessed the application of various tests, the engine—a "Castle"—was opened out to the full and produced an effect which can only be likened to an earthquake! To everybody present, it was obvious that considerably more than 500 h.p. was being absorbed by the plant; and this was more than twenty years ago.

However, I am very glad to see that the recently-published statement has caused Mr. F. W. Hawksworth to write a letter to point out that the plant has been modified from time to time, and that a short time ago, a "King"-class locomotive was recorded as exerting 2,100 i.h.p. on the plant. Further, Mr. Hawksworth also points out that the limiting factor of the plants at Swindon and Rugby is the frictional adhesion between the locomotive driving-wheels and the rollers of the plant, when the locomotive is being run under high-tractive-effort, low-speed conditions, and that the number of rollers provided, so long as they accommodate all the coupled wheels, does not affect these conditions.—J.N.M.

## The Death of Mr. A. F. Plint

● THE NAME of Stuart Turner Ltd. has long been a household word among model engineers, and at nearly every "M.E." Exhibition, the stand of this firm has always been a centre of great attraction. One of the best-known personalities connected with the firm of Sturart Turner Ltd. was their technical director, Mr. Alexander F. Plint, and many readers will share my regret in learning of his death, which took place on October 16th. Mr. Plint was a Yorkshireman by birth, and he joined the firm in 1903. In the course of 45 years' service with the firm, during the last eighteen years of which he was technical director, he was responsible for many designs, in both model and full-size engineering, including the Stuart P.3 petrol engine and the P.55 marine engine. Under the administration of Mr. Plint and his co-director, Mr. H. Sanderson, the firm of Stuart Turner Ltd. has expanded from its very small beginnings into a large and thoroughly up-to-date production establishment, whose products are held in high esteem throughout the world.

*The late Mr. A. F. Plint*

In addition to his technical attainments, Mr. Plint was a well-known public character in Henley-on-Thames, having been a town councillor for very many years, and Mayor of Henley in 1931 and 1932.—E.T.W.

## Ambitious Fareham

● TO ASSIST in achieving their immediate ambition, the Fareham Model Engineering Society are staging their second annual exhibition of models during this month. The aim is to obtain funds to provide a hut for members' use. The site is available, where they hope to lay down a model race car track and a base for line-control flying, and, also facilities for running model boats. If this exhibition is successful, the society can go ahead with these plans.

The second show will be opened by the chairman of the local Council (Councillor J. Alexander, B.E.M., J.P.), on Tuesday, December 7th, at 7 p.m., and will again be held in the Congregational Church Hall, West Street, Fareham, Hants, from December 7th to 11th inclusive. The opening times are: Tuesday, Thursday and Friday, 6 p.m. to 9 p.m.; Wednesday, 2.30 p.m. to 9 p.m. and on Saturday, the closing day, from 10.30 a.m. to 8.30 p.m.

The Fareham Club have had quite a successful year with several outings, and they have gained publicity through displays of models at local functions.

So, all interested readers in the Southern Counties who have a few hours to spare, rally round this club show and make it a bigger success than was their first venture, last year.—W.H.E.

## Model Engineers and War Inventions

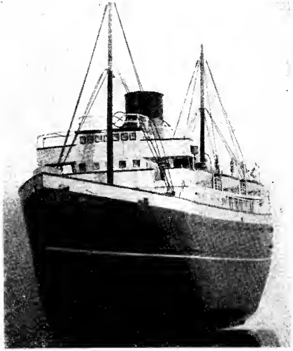
● I WAS very interested to learn that our old friend Mr. Summerscales (better known to readers by his sobriquet "Bro. Two Dollars") was recently awarded £75 by the Admiralty for the invention of an improved jig for drilling the tangential holes in oil-fuel sprayer caps. This calls to mind the fact—often forgotten by the general public — that model engineers have played an important part in the invention and development of many devices which materially helped our war industry. Mention has been made of some of these in THE MODEL ENGINEER in the past; but apart from well-known inventions such as the Sten gun, there are many which will probably never be publicly acknowledged. Whether these contributions were great or small, however, they have all helped to promote progress, no less in the arts of peace than those of war. The ingenuity and resourcefulness which is such an essential factor in building successful models is equally applicable to the solution of practical problems in any field of engineering; and a no less useful faculty of the model engineer, which has on many occasions been a decisive factor in the carrying on of industry under difficulties, is the craftsmanship which rises superior to the limitations of both material and equipment. Nothing could provide a more adequate reply to the criticism encountered in the past, that model engineering is a "useless hobby."—E.T.W.

## From South Africa

● A FRIENDLY letter has come to hand from Mr. Frank Holland, of Johannesburg, South Africa, who states that he is building a 1-in. scale model of a South African Railways' Class 15CA locomotive and was very interested to read about the Class 15F locomotive being built by Mr. D. A. Whiteside, whose descriptive article was published in THE MODEL ENGINEER for January 29th last. Mr. Holland enclosed a letter which we, of course, were pleased to forward to Mr. Whiteside, and we hope that yet another model engineering comradeship will thereby begin. But Mr. Holland gives THE MODEL ENGINEER a very cordial compliment when he writes: "I have been reading THE MODEL ENGINEER since 1921 without a break, except for a few copies which Hitler consigned to Davy Jones, and it is my favourite paper. Many thanks for the happy hours I have spent with THE MODEL ENGINEER. It is a wonderful panacea for the worries of present-day life, and there must be thousands of us who will always be in your debt." Thank *you*, Mr. Holland, for your very kind appreciation; it acts as a tonic to the editorial staff.—J.N.M.

# *A Model Cross-Channel Steamer
## The "BRITTANY"
### by J. E. Jane

AS can be seen from Fig. 19, the anchors are not a genuine reproduction and are only made to look something like the "real thing." A piece of copper piping served as a "cross-piece" with "flukes," cut from sheet brass, soldered on. The stock is a length of $\frac{1}{8}$ in. diameter brass. The chain, I am afraid, is somewhat oversize, as try as I could, the exact scale size could not be obtained.



*The model "Brittany"*

**The Rudder. (Fig. 20)**

This was fabricated. The blade was cut from 20-gauge brass sheet. The stock is a length of $\frac{1}{8}$ in. diameter brass. The brackets were made from lengths of $\frac{1}{4}$-in. brass strip, and the sockets on the stern post, lengths of $\frac{1}{8}$-in. brass strip. The brackets were riveted to the blade and the socket to the stern post. The stock was sweated into position in the brackets.

*Continued from page 555, "M.E.," November 25, 1948.

**Anchor Winch. (Fig. 21)**

This was fabricated from box wood, the only metal parts being the hand levers, which were made from pieces of 1/32 in. diameter steel wire. The complete unit was glued to a beechwood base, which was in turn bolted to the main deck.

**The Deck Seats. (Fig. 22)**

These are of a very simple nature as may be seen from the drawing. The final finish consisted of a light coat of stain, with a couple of coats of french polish.

**Docking Bridge. (Fig. 23)**

The cabin part was formed up in a similar way to the skylights, and the handrails, as for Fig. 4, except that only one intermediate rail was used.

**The Rudder Quadrant (Fig. 24)**

The drawing shows this unit in position. The "V" section (or base) was formed from brass sheeting, the notched radial portion being

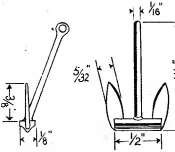



*Fig. 19. Anchors (built-up)*

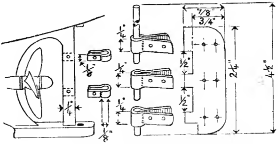



*Fig. 20. Rudder details*

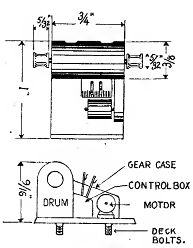



*Fig. 21. Anchor winch*

a separate strip soldered to the " V " The tiller, was filed up from a length of brass. This was sweated to a collar which fits over the head of the stock, and fits flush with the top of the stern tube. A 1/32 in. diameter hole was then drilled through both the washer and stock, and fitted with a taper pin.

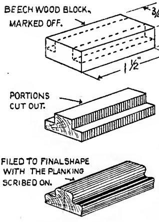



*Fig. 22. The deck seats*

**Power Unit (Fig. 25)**

The choice of power is made according to the builders' fancy. In my case I decided on a very simply made, but efficient, single-acting oscillating unit, with an ordinary type boiler fired by a box-type methylated burner. The whole unit was made completely by hand, and, as in the case of the boat, was chiefly a matter of improvisation.

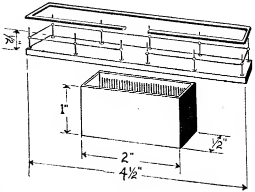
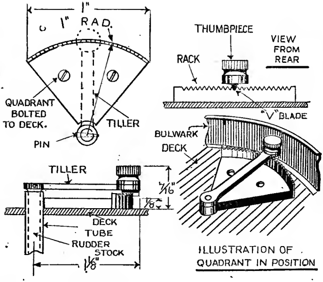



*Fig. 23. Sections of docking bridge*

**Engine (Fig. 26)**

The cylinder was cut from a piece of $\frac{7}{16}$-in. inside diameter brass tubing, of about 16 gauge. (I was lucky in obtaining some tubing with a well polished bore.) The " head " was fashioned from the base of a cartridge case.

The piston-rod, and big-end, were shaped from one piece of round mild-steel. The piston position was lapped into the cylinder with flour emery and oil, until a " suction " fit had been obtained. The length of the rod and big-end was marked off and ground down to a rough shape. The crank hole was then located and




*Right.—Fig. 24. The rudder quadrant*

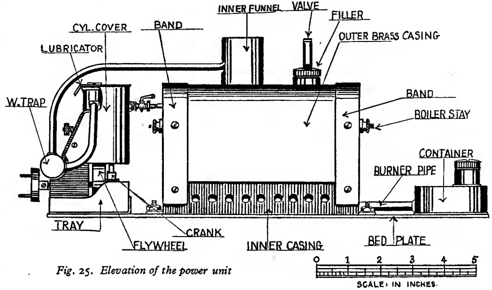



*Fig. 25. Elevation of the power unit*

drilled. The whole was brought to the requisite size by filing and given a final polish with emery-cloth.

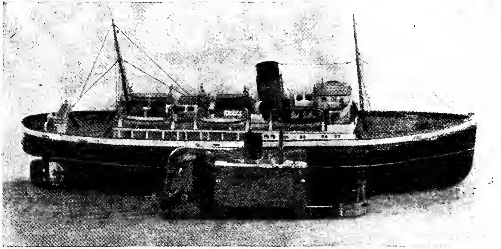
The standard was marked out in a piece of 20-gauge sheet steel cut out, and bent to the required shape. The holes for the shaft, were marked out and drilled, and then fitted with brass plugs which were drilled and reamed to serve as bearings.

The face blocks for both the cylinder and standard were filed up from pieces of brass, to the following dimensions: 1 in. long, $\frac{1}{4}$ in. thick, by $\frac{3}{4}$ in. wide. The cylinder-block was soldered to the barrel and the standard block bolted to the standard as shown in the drawing. The drilling followed the usual practice. The frictional surfaces were filed dead flat, and brought down with the aid of some oil and carborundum powder on a piece of plate glass, and finally polished off with plate-powder.

The flywheel, which was improvised from an old circular gauge, also serves as a crank. Having already a hole through the centre, all that was necessary was to open it out to receive a length of $\frac{1}{8}$-in. d ameter silver-steel for the shafting.

The driving dog was made up from a brass disc, fitted with two pegs and a collar, which was tapped 5 B.A., to receive a set-screw.

The displacement lubricator is a length of $\frac{7}{16}$ in. diameter brass tubing. Both ends are threaded to receive the respective nuts. The steam and exhaust pipes are of $\frac{1}{8}$-in. o.d. and



*The model "Brittany," with power unit removed*

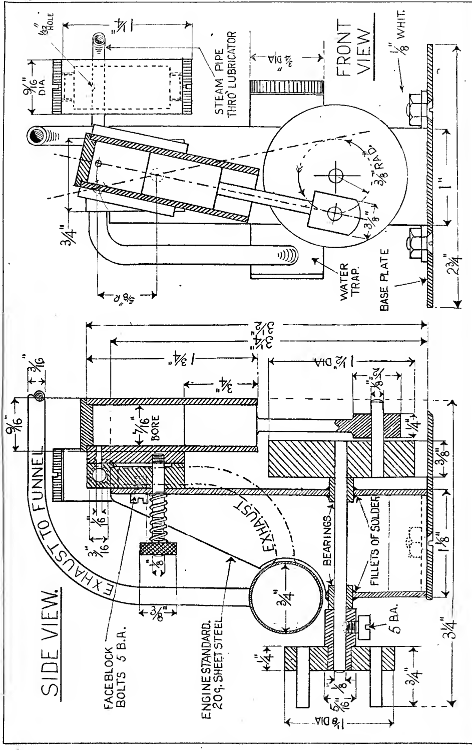



*Fig. 26. Details of the single-acting oscillating engine—$\frac{7}{16}$ in. bore by $\frac{3}{4}$ in. stroke*

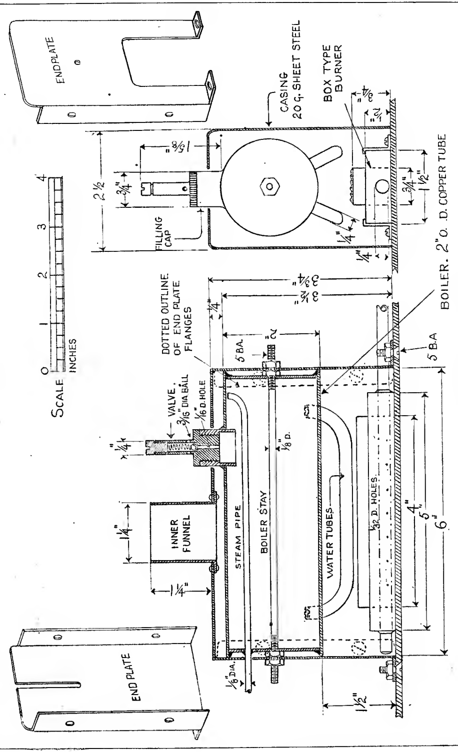



*Fig. 27. Details of boiler, casing and burner*

# Smokeboxes for "Maid" and "Minx"

## by "L.B.S.C."

As there is very little difference between the smokeboxes of the two 5-in. gauge locomotives, one description will do for the pair of them, and that will save both space and "brainstorming." The best material from which they can be made, is a piece of 5¼-in. by 16-gauge brass tube, or a piece of sheet brass rolled to the same diameter and silver-soldered at the joint. There is no need to make them any thicker, as there is no pressure to withstand; nor do I advise the use of steel. There is always a certain amount of dampness inside a smokebox when cold; you wouldn't think so, as the interiors get plenty hot when the engine is running, but there is. On the old Brighton engines, damp smokebox ash used to corrode the plates near the bottom very badly, and it was no uncommon thing to find holes just above the layer of firebricks over the cylinders, in engines due for "shopping." On top of that, a little engine usually begins to "spit water" when on the last lap of a run, and the fire is very nearly out; and this sinks to the bottom of any ash that is in the smokebox, combining with same to form a corrosive fluid that eats into steel like nobody's business. The smokeboxes of all my own engines are either brass or copper, but I prefer the former.

Both "Maid" and "Minx" smokeboxes are circular, and are supported by saddles. The former is 5½ in. long, and the latter 5 in. The pieces of tube can be squared off in the lathe, if a disc of wood is driven into each end. If your three-jaw isn't big enough to hold one end of the tube, put a long wood-screw in one disc near the edge, put on the faceplate, and mount the tube between centres, with the screw engaging one of the faceplate slots. When you have faced off one end of the tube, change the screw to the other end, and "ditto repeato" the whole operation. If a piece of sheet is rolled up, put three or four rivets through the overlap, which need not be more than ¼ in., and silver-solder the joint; then square the ends as above. Anybody who is skilful with an oxy-acetylene blowpipe, could vee the edges, butt them together, and fill the vee with Sifbronze, thus making their own tube; but this requires a little dexterity, because the melting point of the brass is only a shade higher than Sifbronze.

As the outside diameter of the boiler barrel is 5 in., and the inside diameter of the smokebox, if 16-gauge material is used, will be 5⅛ in., a ring $\frac{1}{16}$ in. thick will be needed to fill up the gap. This can be rolled up from sheet, or a ⅜-in. ring parted off a 5¼-in. tube, a small segment cut out of it, and the joint closed up and silver-soldered. I have shown the edge rounded off for appearance sake, but there is no objection to leaving the edge square, and pushing it in flush with the end of the smokebox tube. To prevent the ring sliding back into the smokebox when fitting the latter to the boiler, drill a few No. 48 holes through ring and smokebox barrel, tap 3/32 in. or 7-B.A., and screw in stubs of threaded brass or copper wire. File flush inside and out.

The hole for the chimney liner is 1⅜ in. diameter, cut same way as for the dome bush. The "Maid's" liner is fitted in the centre of the smokebox, 2¾ in. from each end, but the "Minx's" is 3 in. from front and 2 in. from back. The holes for the blast pipe are ⅝ in. diameter, and diametrically opposite, but not exactly underneath the chimney hole, on account of the position of the exhaust flange on the cylinders. The "Maid's" blastpipe enters 1⅛ in. behind the chimney, and the "Minx's" ¼ in.; these will be described when we come to the pipe work, and I will show the steam pipe connections at the same time.

### Liners

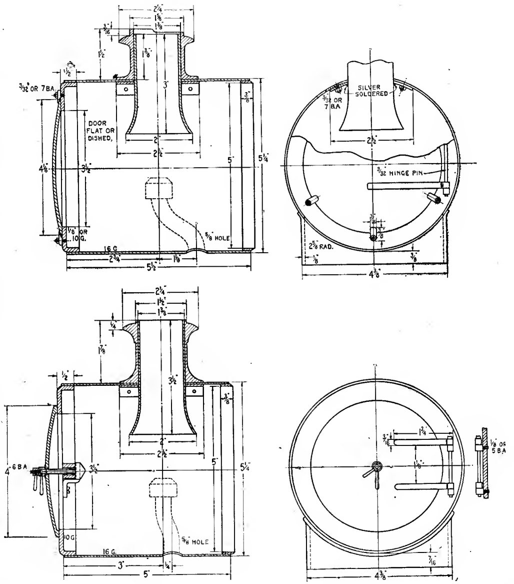
Both the chimney liners are made from 1⅜-in. diameter brass or copper tube, cut to length shown in the illustration. The bottom end is belled out; this is easily done if the tube is first softened. My pet way is to hold the tube in the chuck, put a piece of stout steel rod inside the tube a little way, then start the lathe, and pull the rod toward me, thus kind of spinning the metal outwards. The rod should be well greased. Another way is to drive a tapered drift into the end.

Each liner is mounted in the middle of a square flange. Cut a piece of 16- or 18-gauge brass or copper 2½ in. square; and in the middle, cut a hole in which the liner tube is a tight fit. Bend the flange to the radius of the inside of the smokebox. Drive the liner through the hole—which will need easing with a file, as bending the flange will cause it to go a little oval—to the amount shown in the illustrations, and don't forget to allow the extra $\frac{1}{16}$ in. for thickness of smokebox barrel. Silver-solder the liner into the hole in the flange, and do this job from the concave side, because if any of the silver-solder gets on the side next to the smokebox shell, the flange obviously won't bed home. By the same token, as Pat would remark, take the sharp arris off the inside edge of the hole in the smokebox. Put a smear of plumber's jointing around the liner just above the flange, press it through the hole from inside the smokebox, drill and countersink a No. 40 hole through smokebox and flange, opposite each corner of the latter, and fix it with four 3/32 in. or 7-B.A. countersunk screws and nuts, as shown.

### Smokebox Fronts

The "L1" class on the Southern have flat smokebox doors secured by six dogs. The rebuilt "C" class, big sisters to the "Minx," have the usual dished door, secured by a crossbar, dart and locking handle. Both ways of fastening are shown in the illustrations, and you can take your choice

as to which method you will adopt. Castings will be available for both rings and doors ; if there are no hinge lugs on the ring, the whole of the front can be faced off in the lathe, but if there are cast-on lugs, a very shallow recess should be formed, which will just admit the door. Only face enough barrel, and this can be done by aid of a moderate-sized three-jaw, the ring being mounted on the top steps of the inside jaws and set to run as truly as possible. All my own engines which have circular smokeboxes, are furnished with rings which are simply very tight push fits. The contact




*Smokeboxes—Top, " Maid of Kent " ; bottom, "Minx"*

metal off to leave a perfectly true surface for the door to butt up against, making a perfectly air-tight joint. This is an essential, for if air is drawn in between door and ring, the engine won't steam for toffee-apples. The edge of the ring should be turned to a tight fit in the smokebox surfaces are smeared with plumber's jointing (I use the brand called " Boss White ") and the ring gently tapped into place by aid of a " bacon-rind " hammer. The ring won't shift of its own free will, yet at the same time it can easily be taken right out, should it be necessary any time

to get full access to the inside of the smokebox. Anyway, don't fit the rings to the "Maid" and "Minx" smokeboxes yet; just wait until the plumbing job is all done.

If your chuck won't hold the ring, the only thing to do, is to mount it on the faceplate, in pretty much the same way as I described for mounting the big wheels. Set it flange outwards, with a piece of wood between it and the faceplate, and a bit of bar across the door hole, with two bolts through it, spaced apart as far as the hole will allow. After turning the rim and facing off the flange, reverse it, and hold it to the faceplate by three dogs around the edge, setting it to run truly. The recess for the door can then be made easily enough with a knife tool set crosswise in the slide-rest tool holder.

The door will have a hefty boss cast in the middle of the convex side, and if this is gripped in the three-jaw, the contact edge can be faced up, and a weeny skim taken off the periphery, to true it up and match the recess in the ring. As the hinge lugs are only just clear of the contact edge, don't take too much off and cut into them. The door can then be reversed, and held by the edge—a 4-in. three-jaw will hold it easily—and the chucking piece parted off or turned away; the stub left being centred and drilled No. 21 for the dart spindle, if you are using centre-fastening. If using dogs, face the boss flush with the door, and don't drill at all.

Both door and ring can, of course, be knocked up from brass blanks, in a manner somewhat similar to that described for smaller engines; but in this size it is hardly worth while, when castings are available which would save time and labour.

### Door Hinges

Clean up the hinge lugs on both door and ring with a file, then put the door in place, and temporarily fix it whilst you drill the holes for the hinge pins. The "Minx's" door is easily held by a 5/32-in. screw through the hole in the middle, running into a tapped hole in a bit of bar across the door hole on the flange side. The "Maid's" door, if dog fixing is used, will have to be held by a couple of toolmaker's cramps, unless you fit the dogs first, and the hinge pin after. Make a centre-pop on the hinge lug at top and bottom. I drill the holes on my big drilling machine, using a drill stuck into a bit of $\frac{3}{16}$ in. rod extending far enough out of the chuck, to prevent it from rubbing against the ring. The ring is held in the machine-vice on the table, and the drill "sighted" by pulling down the drill in front of the lugs. If it passes squarely across the lot, the ring must of necessity be set correctly, and the two top lugs are then drilled. The casting is then turned upside down in the vice, the drill sighted in front of the lugs again, and the other holes drilled. The hinge pin is a piece of 3/32-in. silver-steel, or 13-gauge spoke wire; the end is turned down to $\frac{1}{16}$ in., screwed 10-B.A. and a weeny head screwed on. If spoke wire is used, and a head is already formed on it, you can use the bit close to the head, and that will serve. Use No. 41 drill.

If your ring casting hasn't any lugs, or if you knock up the ring from a brass blank, separate lugs will have to be made. This is just a kiddy's practice job, a bit of $\frac{3}{16}$-in. square brass being chucked truly in four-jaw, the end turned down to $\frac{1}{8}$ in. diameter for $\frac{3}{16}$ in. length, and screwed $\frac{1}{8}$ in. or 5-B.A. Part off $\frac{1}{4}$ in. from the shoulder, and round off with a file; screw the stems into tapped holes in the ring, as shown in the detail sketch. Hinge straps for a door made from a brass blank, can be made from a strip of 18-gauge steel $\frac{3}{16}$ in. wide, the end being bent around a bit of 3/32-in. silver-steel, or 13-gauge spoke wire, the joint being silver-soldered. The straps are riveted to the door by bits of $\frac{1}{16}$ in. soft wire, any metal. Countersink the holes in the strap, and after riveting, file them flush, or the cleaner boys won't be able to polish them up with emery-cloth, like they did in the old days on the L.B.S.C.R. Some of the smokebox fronts were a picture, the handrail, handles, hinge straps and lamp irons gleaming like silver; whilst at the top of the door you would usually see the boy's "trademark" scoured out in the black paint. Sometimes it was a star and crescent, or a pair of horns, or a clover or shamrock leaf, or a garter, or even a simple monogram; and by just looking at the smokebox door, you could tell who was the regular cleaner. Alas, *those* days will never come back any more!

### Dogs and Darts

The dogs which don't bark but have a pretty good bite, are made from bits of $\frac{1}{8}$-in. by $\frac{3}{16}$-in. mild-steel or brass, $\frac{5}{8}$ in. long. Round off the ends, bevel off one end as shown in the general arrangement of the smokebox, drill a No. 40 hole through the thick end, and attach to the smokebox ring either by 3/32-in. studs and nuts, or 3/32-in. or 7-B.A. set-screws, which should have hexagon heads for appearance sake. The studs or set-screws are spaced equally, the three lower ones being shown in the part-section view of the "Maid's" smokebox; set them about 5/32 in. from the edge of the door, so that when the nuts or screws are slacked off, and the dogs turned around, the door swings open without touching them. When tightened, the dogs should keep the door closed air-tight.

The crossbar for the centre fixing, is made from two $4\frac{1}{2}$-in. lengths of $\frac{1}{8}$-in. by $\frac{3}{8}$ in. flat mild-steel rod, riveted together with a $\frac{3}{16}$-in. spacer near each end. It is supported across the centre of the door hole, by two brackets bent up from sheet steel about 16-gauge, screwed to the inside of the ring. To get the exact height of the brackets, I always make the dart and handles, set the bar in position so that the head of the dart engages properly, and then fit the brackets to the bar.

To make the dart, chuck a bit of $\frac{1}{2}$-in. round steel in the three-jaw. Face the end, then turn down $1\frac{3}{8}$ in. length to 5/32 in. diameter. Further reduce $\frac{5}{16}$ in. of the end to 7/64 in. full, and screw 6-B.A. The next $\frac{3}{16}$ in. is filed to a $\frac{1}{8}$ in. square, and as I have described how to file true squares umpty-one times, need not repeat that bit. Part off at $\frac{5}{16}$ in. from the shoulder. Reverse in chuck, and turn the $\frac{1}{2}$-in. blob to a blunt cone, then file it flat, to the thickness of the spindle. Note—the length of dart given above, is based on the assumption that the radius of the dishing is $7\frac{1}{2}$ in., and that the door, when turned on the contact face, stands out $\frac{3}{8}$ in. from the smokebox ring.

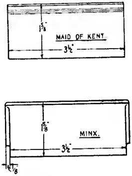
If the door is different from these measurements, alter the dart to suit. This is easy enough; the squared part should enter a bare $\frac{1}{16}$ in. into the hole in the middle of the door, so as to allow for tightening up.

The key that turns the dart is simply a $\frac{3}{16}$-in. slice off a $\frac{5}{16}$-in. round steel rod, with a square hole in it. Drill the hole $\frac{1}{8}$ in. before parting off, file it square with a watchmaker's square file to fit the square on the dart, and drill and tap a 9-B.A. hole in the side for the handle. This is a $\frac{5}{8}$ in. length of 3/32-in. round steel filed slightly taper whilst held in the chuck with the lathe running fast, and screwed 9-B.A. to fit the boss. The locking handle is a similar length of $\frac{1}{4}$-in. round steel, drilled and tapped 6-B.A. to suit the screw on the end of the dart, and furnished with a similar handle $\frac{1}{2}$ in. long. Round off the ends of both handles, or there may be one or two fresh words added to the dictionary of Railroad Esperanto if you grab them quickly! Mention of smokebox handles reminds me of a joke that misfired, soon after I went to work at the locomotive sheds. A fitter, deceived by my "innocent angel" appearance, asked me to fetch him from the stores the key of the smokebox for the engine he was working on. I said "yes, certainly," and went up the shed, quietly tipping off some of the cleaner boys to come and get a laugh. Whilst they went down the shed, I went to the far end and got the complete dart and two handles off an old Kitson goods engine that was standing "dead," took them back to the fitter and held them out to him, saying very demurely, "I've brought the lock as well, in case the key didn't fit." There was a roar of laughter from the other boys, and the look on the fitter's face was, as we used to say at school, "worth a guinea a box," but he took it in good part and said with a grin, "All right, kid, you win—you know something!"

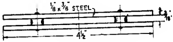
### Smokebox Saddles

These will be cast, and merely need cleaning up with a file. There is a little difference between the two; the "Maid's" saddle has side flanges only, the radius at each end being flush with the plate. The saddle for the "Minx" has a continuous flange around sides and ends, similar to the saddles of American engines. Both saddles are full width of frames, and fit over the tops of the steam chests, their sides resting on the frames; directions for fixing will be given when we come to the job of erecting the boiler.

I have also included in the smokebox drawings, the outlines and dimensions of the chimneys. These are castings, and the easiest way of turning them would be first to hold them, base outwards, in the three-jaw, if you have one large enough. If not, mount on an angle-plate attached to faceplate, laying the casting on its side with a bar across it, held down by a bolt at each end, similar to a small cylinder casting. Set to run truly, then bore out until a piece of $1\frac{3}{8}$-in. diameter bar or tube is a tight push fit. Then mount the casting on a mandrel, between centres




*Smokebox saddles*




*Crossbar*

for preference, and turn the outside to the profile shown, or any other that you may fancy. The bottom radius can be cleaned up with a file. Though both the "L1" and "C" class chimneys in full size are black, the "Minx" would look smarter with the top polished bright. Anybody who wants to fit the "Maid" with a similar "New Look," should make a slight difference in diameter between the bright and black parts; or alternatively, leave a weeny "bead" between the barrel of the chimney and the cap. Another alternative would be to use the "Minx" chimney, shortened to suit. The cast chimneys are not fixed to the smokebox in any way, merely being a tight push fit on the liner. Next stage, boiler fittings.

# A Striking Coincidence

In the course of my life, I have experienced a few, but not very unusual coincidences; but the latest is, perhaps, the most striking of them. In The Model Engineer for December 17th, 1936, there appeared a diagram, photograph and description of a neat, outside-cylindered 2-4-2 type tank engine built by Bagnall's for the Egyptian Government Railways. On November 10th, 1948, I received a letter from a reader referring to that article and asking if I could put him on to any drawings or description of any similar engines built for a British railway. I could not do so, for the simple reason that, so far as I know, nothing like those Egyptian locomotives has ever been built for use in Britain; but that is by the way. The coincidence occurred just two days later, when on opening my copy of a contemporary journal, dated November 12th, 1948, I was astonished to find in it the same article and illustrations that had been published in The Model Engineer twelve years previously!

Why did this happen within two days? I do not know, and cannot even guess!—J.N.M.

# IN THE WORKSHOP

## by "Duplex"

### 25—Lathe Filing-rests

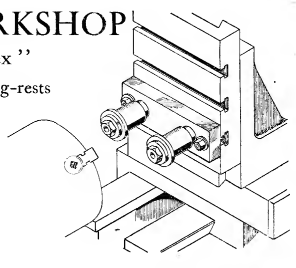


*Fig.* 1. *Filing-rest attached to milling-slide*

WHEN a suitable form of adjustable roller filing-rest is mounted on the lathe saddle, a variety of operations can be carried out that would otherwise entail the use of a milling attachment or the provision of milling cutters. With the aid of the rest and an ordinary file, however, the work done will be sufficiently accurate for most purposes; for example, this offers an easy method of forming double or hexagon spanner flats on the end of a screwed collar turned in the chuck, or similar flats can be filed on a shaft mounted between the lathe centres, or, again, a square can be formed on a shaft or at the end of a component held in the chuck.

The essential parts of the device are the two guide rollers that serve to regulate the depth to which the file can penetrate into the work, and, at the same time, the flanges of the rollers act as stops to determine the breadth of the file cut.

Needless to say, these rollers should be fully hardened to prevent their being worn by the file teeth and, in addition, both they and their pivots must be accurately made and fitted to ensure true and free rotation without end- or side-shake.

The roller assemblies are secured to a base-piece or carrier which should be provided with some means of vertical height adjustment to control the depth of filing, and so the dimensions of the finished work.

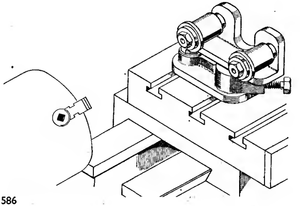
Where the work is held in the chuck and the tailstock centre is not in use, a ready means of providing this adjustment is to mount the base carrying the rollers on the vertical milling-slide belonging to the lathe, as illustrated in Fig. 1.

The screw feed of the slide, controlled by its micrometer index, will then enable an accurate height setting to be readily made.

If, however, the work is supported by the tailstock centre, it will be clear that a different form of mounting will be required.

For this purpose, as shown in Fig. 2, the rollers must be mounted on a forked member in order to allow a passage for the work; and, to save having to make a special fitting, the base of the lathe hand-rest can usually be employed for holding the shank attached to the roller fork. Here, the height adjustment is obtained by raising or lowering the shank of the fork in the hand-rest base by means of a graduated finger wheel, or, more simply by fitting a fine-thread elevating screw to the fork base as will be described later.

With the latter type of attachment, when fitted to the cross slide of a small lathe, the amount of adjustment available is necessarily somewhat limited if the rigidity which is essential for successful working is to be maintained. With this in mind, provision has been made to allow for a preliminary setting of the roller



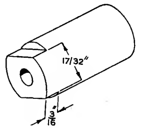



*Fig.* 3

*Left.—Fig.* 2. *Fork-type filing-rest attached to cross-slide*

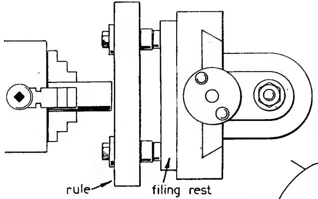



*Fig.* 4

pivots in slotted holes in the fork member, in order to set the position of the rollers in accordance with the diameter of the work; subsequent adjustment during the filing operation is then made solely with the aid of the screw mechanism.

**Using the Filing-rest**

Let us suppose, for example, that, as represented in Fig. 3, two spanner flats have to be filed on the end of a bush that has been turned to an outside diameter of $\frac{5}{8}$ in.; the diameter across the flats is required to fit a $\frac{1}{4}$-in. Whitworth nut-size spanner with a 17/32-in. gap.

The vertical milling-slide is secured to the cross-slide of the lathe with its table set upright and aligned horizontally with the aid of a rule in contact with the chuck face, or this latter setting can be made with a square held against the rear edge of the cross slide. A quick and easy method of setting the vertical slide truly upright is to feed the table downwards until it comes evenly into contact with the flat upper surface of the lathe bed; the pivot clamp-bolt is then tightened with the table in this position.

The base member of the filing-rest carrying the rollers is secured to the table of the slide by means of bolts engaging in the T-slots as represented in Fig. 1.

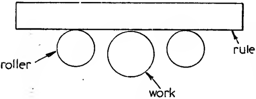



*Fig.* 5

Place a rule in contact with the flanges of the guide rollers and traverse the saddle until the edge comes into contact with the face of the work, as shown in Fig. 4; then traverse the saddle with the aid of the leadscrew index the exact distance, say, $\frac{3}{16}$ in. required to form the breadth of the flat. Lock the saddle in this position and keep it so for the remainder of the filing operation.

The rest is now raised by means of the slide feed-screw until a rule or straight-edge touches the work and both rollers simultaneously, as illustrated in Fig. 5; the slide feed-screw index is then set to the zero position.

Now, as the bush is $\frac{5}{8}$ in. in diameter and the flats have to be 17/32 in. apart, the total amount of metal to be removed is $\frac{5}{8}$ in. less 17/32 in., which is 3/32 in. or, say, 0.094 in. leaving 0.047 in. to be filed away to form either flat to size. Therefore, lower the slide for more than this distance and then raise it

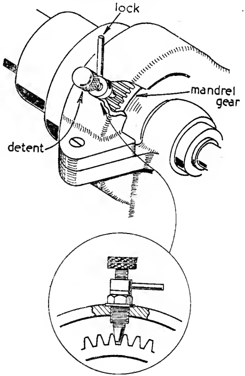



*Fig.* 6

until the index reads this amount from the zero mark.

When setting the slide in this way it should always be raised so that its weight will eliminate any backlash in the feed mechanism; for if, on the other hand, the slide is lowered to make the adjustment, it will then be able subsequently to fall further for a distance equal to the amount of backlash present in the feed. When this adjustment has been made, the slide should be securely locked, and the rest is now accurately set to restrict the travel of the file to cut a flat of the required dimensions.

Before embarking on the filing operation, however, it will be necessary to secure the mandrel from rotating and, at the same time, to provide a means of locating the second flat exactly opposite the first.

As considerable pressure tending to turn the mandrel may be applied to the work during the filing operation, it is essential that the mandrel should be firmly locked. The method of dividing the work and locking the mandrel by means of a change-wheel fixed to the tail of the mandrel may not be found to afford sufficient security when heavy filing is undertaken, and it is preferable for this purpose, whenever possible, to make use of the large back-gear wheel which is keyed to the mandrel. This wheel as fitted to the Drummond

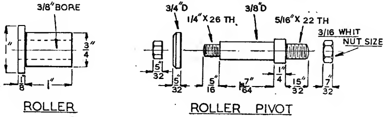



*Fig.* 7

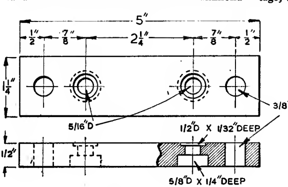



*Fig.* 8

Myford lathe, for example, has 66 teeth and may, therefore, be employed for indexing both double and hexagon flats by means of a screwed detent fitted to the rigid wheel-guard as illustrated in Fig. 6.

Where the design of the lathe does not permit of using this method, dividing can readily be carried out from a series of holes drilled in the periphery of the chuck backplate, or in the lathe driver plate, in conjunction with a detent secured to the lathe bed, or headstock, as may be determined by the design of the lathe in question. This method has the advantage that it entails no risk of errors arising due to the chuck unscrewing on the mandrel nose.

Should it be decided that indexing into 2, 3, 4, 6 divisions will suffice for all ordinary work when using the filing-rest, then by determining the lowest common multiple of these numbers it will be clear that 12 holes will be required.

When the filing-rest has been correctly set as described and the mandrel securely locked, the actual filing operation can be undertaken. For this purpose, a file of the type known as a "hand" file should be used, that is to say its edges are parallel and it is consequently of uniform breadth and not tapered towards the point, as in the ordinary "flat" file. In addition, the hand file has one smooth edge which can conveniently be used for guiding the file against the flanges of the guide rollers.

Where much metal has to be removed, the use of a bastard-cut file will be found an advantage, and this may be followed by a "smooth" file for finishing the work.

The actual filing is carried out with firm, well-controlled strokes, and although in the initial stages the blade may make contact with only one roller, for the sizing and finishing operation the file is pressed into contact with both rollers simultaneously, and its edge is kept in contact with the guide flanges throughout.

When the stage is reached where the file ceases to cut, a measurement can be taken with the micrometer to ascertain that the required depth has been reached; if this is not the case the slide is reset accordingly and the filing operation is repeated. The work

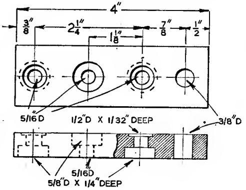



*Fig.* 9

is then indexed in the diametrically opposite position and the second flat is filed in the same manner. Should the breadth of the flats prove insufficient, the saddle is moved forward with the aid of the leadscrew index and the surplus metal is removed as already described, but in this instance the operation will be facilitated if the toothed edge

of the file is brought to bear against the flanges of the guide rollers.

When filing work mounted between the lathe centres the procedure is essentially similar, except that the form of rest illustrated in Fig. 2 is used in order to provide a passage-way for the work.

As in the previous example, the rest is set to form the required breadth of flat by means of the leadscrew and its index, but the height setting of the rollers is adjusted by turning the knurled finger wheel shown in the drawing or by means of the elevating screw later described. The wheel should be graduated in accordance with the pitch of the thread used to enable exact settings to be made.

As the rest is positively raised when the wheel or screw is turned, adjustments are made by moving the rollers in the upward direction both when finding the zero position and when putting on the depth of cut. As has already been mentioned, the vertical travel of a rest of this type suitable for a small lathe is somewhat limited, and the pivot holes in the fork are, therefore, slotted to allow an initial adjustment to be made, leaving the screw feed to operate over the distance necessary for cutting the flats to the depth required. At the outset, therefore, the rest is raised by the screw mechanism, and the roller pivots are set to bring the guide rollers level with the upper surface of the work; the final exact setting of the height of the guide rollers is then made by operating the screw feed.

## Making the Filing-rest

The construction of the guide rollers and their pivot assemblies will be dealt with first, as these components are common to both types of base mountings later described.

The rollers themselves are turned from mild-steel bar to the dimensions given in the working drawings in Fig. 7; the sizes indicated can, however, quite well be varied to suit particular needs or to enable material in stock to be used.

As the important consideration is that the bores should be truly concentric with the guide surfaces, the machining should be at one setting of the rod in the chuck and the bore should be finished with a small boring tool. In order that the guide flanges of the rollers may lie in the same plane, it is essential to machine the parallel faces of the rollers to exactly the same length by making use of the leadscrew index.

On completion of the machining, the bores are carefully hand-reamed to remove the tool marks, and the rollers are then case-hardened to protect them from the cutting action of the file teeth, and also to ensure freedom from wear in the bores.

The bores are finally brought to a high and accurate finish by means of an internal lap charged with fine carborundum powder and mounted in the drilling-machine.

The pivots are turned from mild-steel or silver-steel rod, but two points should be noted in connection with the machining: first, the shouldered portions must be of exactly equal length to ensure that the rollers line up correctly: secondly, the middle third, that is to say $\frac{3}{8}$ in. of the parallel portion of the pivot should be reduced in diameter by a few thousandths of an in. to allow the roller to take a bearing only on the two outer thirds of its length; this procedure will prolong the accurate working life of the bearing by preventing any tendency for the roller to tip about the centre of the pivot.

The bearing surface of the pivot must not only be finished exactly parallel, but it should also be finally polished by the judicious use of fine emery cloth. If, as is advisable, a preliminary lapping operation is carried out on the unhardened pivot, care must be taken to prevent abrasive grains becoming embedded in its surface, for if the pivot remains charged with abrasive it will then act as an internal lap under working conditions. This can be avoided by using what is termed a non-charging type of abrasive, such as powdered oilstone, which can readily be removed from the surface of the work on completion of the lapping operation.

Where the bearing surfaces are highly finished and accurately fitted, it may be found, as in the rest actually constructed, that the rollers will spin freely when dry, but if oil is introduced they will tend to drag slightly; for this reason it may be preferable to keep the bearing free from oil, and in practice no wear of the parts has been experienced by so doing.

The thrust collars are turned and threaded in the usual way, and for the latter operation the tailstock is used to guide the tap.

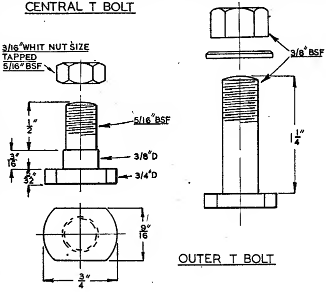



*Fig.* 10

The faced end of the bar should be reserved for the thrust face, and after the collar has been parted off, it is mounted on a threaded stub for surfacing and chamfering the outer face against which the lock-nut bears. Two diametrically-opposite $\frac{1}{16}$-in. diameter holes are drilled at the periphery of the collar to take a tommy-bar when adjusting the thrust.

**Base Mounting for the Vertical Slide**

The base on which the rollers are mounted is illustrated in Figs. 1 and 8, where a base-piece suitable for use with a vertical slide 5 in. in breadth is shown. This part is also made from mild steel, and it is essential that it should be accurately machined to ensure that the rollers stand truly at right-angles to the surface of the vertical slide.

After the under surface of the base has been scraped flat by reference to a surface plate, the bolt and pivot holes are marked out and drilled to size. The base is next bolted, upper surface outwards, to the lathe faceplate and a light cut is taken across the work to true its surface. The pivot holes are in turn centred and then spot-faced with a small boring tool; this operation should be carried out with reference to the lead-screw index to ensure that the machining is to the same depth for both pivot seats. The work is next reversed on the faceplate and the recesses for the pivot nuts are bored out in the same way. This completes the machining and the components can now be assembled; the pivots are firmly bolted in place in the base, and the thrust collars and locking-nuts are adjusted to allow the rollers to turn freely but without end-shake.

The machining of the T-bolts is a straight-forward turning operation, and it is only necessary to ensure that both the shank and the head will engage correctly in the T-slots of the vertical slide used.

If a vertical slide with a table narrower than 5 in. is used to carry the rest, as in the case of the Myford attachment, which has a table 4 in. in breadth, it may be necessary to modify the position of the securing bolts. Fig. 9 illustrates a base mounting for use with a table 4 in. in width. Here, the positions of the pivots and the outer securing bolt are as in the previous design, but the second securing bolt is placed centrally between the rollers; further, to maintain the full working space between the rollers the nut is housed in a recess like those of the pivots.

The two T-bolts suitable for attaching the rest to the Myford vertical slide are shown in Fig. 10, and it will be seen that the central bolt is threaded $\frac{3}{16}$ in. B.S.F. to take a nut similar to those used for securing the pivots.

*(To be continued)*

# Time from the Mains

*(Continued from page 581)*

sheet brass, using flycutters and a home-made dividing-head. To obtain the necessary vertical movement, the top slide of the Super Adept lathe was attached to the cross-slide in an upright position by means of a small angle-plate. The working surfaces of the teeth were finished by the lapping process, described in THE MODEL ENGINEER (May 8th, 1947). Pinions were cut from silver-steel, likewise considered to be the best material for the staffs. All screws, with the exception of those in the field magnet assembly, were made from the same material, hardened, polished and tempered dark blue. Sheet brass was sawn and filed to shape for the plates, bearing-brackets, etc.

Rather than wind the coil, for which wire of suitable gauge was unprocurable, an old audio transformer from a very old radio set, was pressed into service. After the primary and secondary were connected together to increase the resistance, the ends of the coil were connected to a length of flex, and the coil taped up with cotton tape, varnished and baked to insulate it properly. For anyone wishing to wind a coil, there are a number of useful pointers in a series of articles in this journal by E. T. Westbury dealing with miniature ignition equipment. Those interested should turn up their issues of a couple of years ago before winding a coil, as many problems on the handling of fine wire and insulation are covered there. Although the insulation requirements in this case are not nearly so exacting, they are somewhat similar. For those who have no the necessary data for calculating the numbers of turns of wire required, it may be better to wind a coil of 200 or 300 turns of 26 s.w.g. enamelled copper wire and drive the clock from the secondary of a 4-volt transformer, rather than directly from the mains.

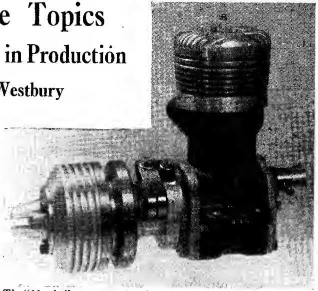
As the writer likes working in wood, a suitable case was made and veneered in walnut. The mechanism is completely enclosed to exclude dust, which would have little serious effect on parts other than the ball-bearings, which it was feared would give trouble, if much dust entered them. Small studs were preferred to numerals, so these were turned from $\frac{3}{16}$-in. brass rod and silver-plated by immersing them in a solution made by dissolving freshly precipitated silver nitrate in photographic hypo solution. Similar treatment was applied to the bezel and hands, which were made from 0.005-in. shim brass, obtained from a local mechanic.

Many hours of quiet enjoyment (yes, literally many hours—on a commercial basis the clock would have cost as much as a well-made full case clock) were the reward as piece after piece took form and finally, what had been once rather vague ideas became reality in wood and metal. Other readers who would like to tackle a similar job need have no fears about it—the work is not nearly as exacting as that required in building a locomotive or a petrol engine, and need take little time in a well-equipped workshop.

# Petrol Engine Topics

## Racing Two-Strokes in Production

### by Edgar T. Westbury



*The "Nordec" 10-c.c. engine, fitted with flywheel and centrifugal clutch, for use in model racing cars*

IN the many years during which I have been writing articles on small petrol engines in THE MODEL ENGINEER, I have adhered closely and consistently to the policy of assisting the amateur constructor, by providing designs, constructional descriptions and other information applicable to his special requirements. Within recent years, the growing popularity of the commercially-produced engine has created a demand for information on the handling and running of engines, as distinct from design and construction; and, incidentally, has produced a new and prolific school of writers who deal with the subject exclusively from this aspect. Although often urged to follow similar tactics by some of my readers, I have considered it more in keeping with the policy of THE MODEL ENGINEER to continue with the infinitely more difficult work of developing designs specially suited to the requirements of the amateur—which are, generally speaking, very different from the popular developments in the field of commercially-made engines.

Unfortunately, however, a few of my readers have interpreted this as a diehard policy, and an obstinate antagonism to the ready-made engine, which might have been understandable, if not excusable — had it been true. But it is not true; on the other hand, I have often given encouragement and publicity, not to mention practical assistance, to manufacturers of engines, though never at any time relaxing my efforts to urge and exhort readers to build their own engines in their home workshops. There is nothing inconsistent in this policy, as some of my readers seem to think; the fact is that I am keen on both home- and factory-made products, but I believe that the latter should be a supplement to, and not a substitute for, the former. The belief that many amateurs were likely to be deterred from building engines, by the predominance of the commercially-made engines, however, has led me to speak rather strongly on this subject.

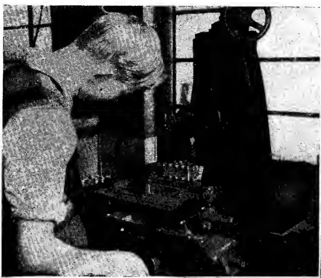
In this respect, I regard the importation of foreign engines as a very real menace; no matter how good these engines are, they are not better than we can produce in Britain, given reasonable opportunity; and another reason for avoiding them is that the credit for any successes attained with their aid must necessarily be claimed by the country in which they were produced. The difficulty and expense of obtaining them here tends to make competitive model engineering an "exclusive," and to some extent, a "rich man's" hobby—which I, at any rate, am strongly against. If we are to have commercially-made engines in British competitions, let them be British engines. The old slogan "Britain can Make It" is just as true in this field as in any other, and I have no doubt whatever of the ultimate success of really determined efforts to demonstrate this fact.

Until after the war, there had never been any serious attempts to produce miniature internal combustion engines in large quantities in this country, mainly because no considerable market for them had ever been visualised. In America, however, where things have always been done in a big way, or not at all, the prospects of a large home market justified the setting up of production plant specially for their manufacture, and as so often happens in industry, the fact of the products being available helped to create an ever-widening demand for them in various fields, including some which had hitherto been scarcely visualised. At the present day, the production of miniature engines in America is quite a substantial national industry, and the more prominent manufacturing firms are sufficiently prosperous to be able to expend large sums on research and development.

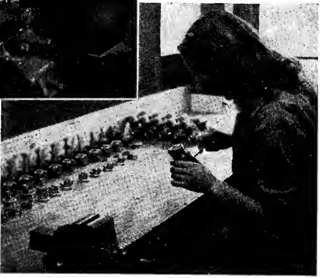
It is, however, extremely doubtful whether such favourable conditions for the development of miniature engine production could ever be obtained in this country, especially in view of present industrial difficulties and restrictions. There has, it is true, been a very intensive development of production in small compression-ignition engines, mainly because this class of product was suitable for manufacture in small and not very highly-equipped factories, which were in most cases already in existence, though

largely idle in the aftermath of wartime subcontract work. But in all classes of small engines, the home market must necessarily be limited, and there are great difficulties in the expansion of export markets, especially in view of keen and ever-growing foreign competition. Several manufacturers of small engines are at present somewhat apprehensive of the prospects of markets becoming over-saturated before very long.

I have considered these aspects of engine production in some detail, because they help to answer a question which I am so often asked, namely "why can't we compete with the Americans in the field of miniature engine production?" It is easy to see that all the cards are stacked against us, when we attempt to produce engines in such large numbers, or so cheaply as the Americans, or to develop engine design, which is always an expensive business. But that does not mean that we must throw up our hands in despair, and abandon any attempt to produce engines on up-to-date lines. There is a very definite field for British-made engines of high quality, even though they cannot be made in tens of thousands and assembled on a conveyor-belt system; and I am glad to say that determined efforts are being made at present to cater for this demand. I know of two British firms who are already producing high-efficiency two-stroke engines of 10 c.c. capacity, suitable for control-line aircraft, racing cars and speed boats, and there are further new schemes at present in development which I hope to be able to bring to the notice of readers in due course.



*Above.—Surface-grinding side faces of piston rings*

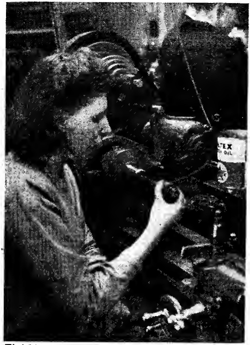


*Right.—Engines in course of assembly*

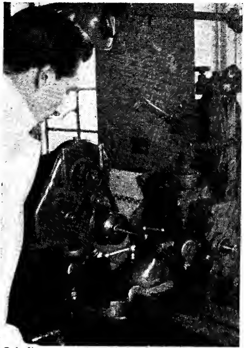
### The "Nordec" 10-c.c. Two-stroke Engine

This engine made its first public appearance at this year's MODEL ENGINEER Exhibition, where it attracted a great deal of attention among racing enthusiasts. It is produced by the North Downs Engineering Co. Ltd., of Godstone Road, Whyteleafe, Surrey, who are newcomers to this particular field, though they are old-established in precision engineering work, and have for some years been well known as the makers of superchargers for motor cars. In their new departure, they have produced a design of miniature engine which follows the trend of the latest American racing engine practice, a policy of prudence, both in avoiding the necessity for protracted development work, and also in capturing the fancy of those enthusiasts to whom American design represents the acme of perfection.

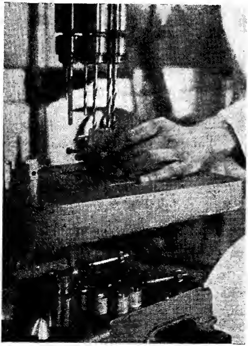
As I have so often pointed out to readers, it is one thing to adopt an efficient design, and quite another to produce it in such a way that the inherent or potential advantages of the design is fully realised. My first reaction to the "Nordec" engine, as seen at the Exhibition, therefore, was a



*Finishing cylinder-liner bores on a Delapena honing mandrel*



*Grinding crankshaft journals on a universal grinder*

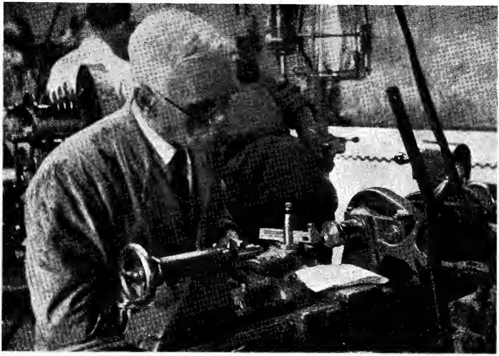


*Jig drilling operations on piston, using a multiple spindle drill head*

*Gang-milling fins on cylinder-heads*

cautious one—"It looks good, but I wonder what sort of a job they make of it in the normal course of production?" In case readers may consider this attitude unnecessarily suspicious, let me say that in the past, many engines which appeared most impressive—especially the exhibition samples—and have elicited eulogies of praise from observers, have been badly let down by slipshod production methods, or lack of care in assembly and inspection.

alloy, and are finished on the working surface by diamond turning; they are fitted with two rings, and these also are produced in the factory, using material and methods in conformity with those normally accepted as standard in ring manufacture, including surface grinding of the sides, and cylindrical grinding on the outside while in compression. Connecting-rods are drop-forged in high-tensile aluminium alloy, and are bronze bushed at the big-end.



*Second-operation work on flywheels, in a centre lathe*

Through the courtesy of the manufacturers of the "Nordec" engine, I have been able to obtain first-hand information on the production of these engines by a visit to the factory, in which every facility was given for inspecting all operations and asking questions of the staff; and as a result, I can now say without hesitation that the engines are a conscientious job, produced from good and suitable materials, by sound machining methods, to limits of accuracy which are at least as high (to my certain knowledge) as those observed in the standard productions of some of the most highly reputed foreign engine manufacturers.

The main components of the engine structure are sand cast in DTD 424 aluminium alloy, heat-treated before machining, and anodised to produce a durable finish on unmachined surfaces. Machining is carried out on heavy turret lathes, using jigs to ensure accurate setting up of the castings, though in some cases "second-operation" or single-tool processes are carried out on centre-lathes. The pistons are produced from gravity die-castings in special low-expansion

The crankshaft of the engine is fabricated in three parts—main journal, crankweb and crankpin—assembled by pressing, and copper-brazed by modern methods, which ensure complete penetration of the joint, and a tensile strength virtually equal to that of a solid crankshaft. Finally, the main-journal and pin are case-hardened and ground. The cylinder liners are of alloy steel, the ports being jig-drilled and squared out by a punching operation before finishing, which comprises external grinding, and the honing of the bore surface in a centre-lathe with the aid of a Delapena honing mandrel. Both the cylinder head and the finned cylinder jacket are machined from solid alloy bar, the former entailing a gang milling operation to produce the vertical cooling fins. The rotary admission-valve is produced from a casting in aluminium alloy, and wear of the working face is avoided by the fitting of a thin shim on the shaft, which prevents actual contact of the valve with its seating.

A conventional form of plain tube carburettor,

(*Continued on page* 596)

# *SLIDE- AND PISTON-VALVES

## by "Battiwallah"

WHAT we have so far explained is fairly simple and straightforward so far as concerns non-reversing engines. The question naturally arises: "What is the effect of introducing reversing gears?" And that is not quite a simple question to answer in full. But we can dwell upon the answer sufficiently to enable the would-be designer to apply the principles to a reversing engine. Take first the case of a Stevenson's reversing gear. Provided that the link is designed so that in full, forward, or reverse gear the eccentric-rods can be brought into line with the valve-rod, the conditions are just the same as in a non-reversing engine. Fig. 5 makes this clear. When the gear is "linked-up," the stroke is shortened and the cut-off occurs earlier. The ports also open earlier to steam admission. The magnitude of these changes is a complicated business to work out and is beyond the range of our present discussion.

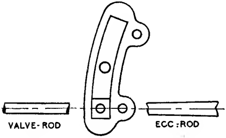



*Fig. 5*

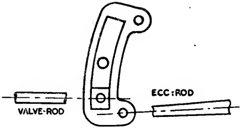



*Fig. 6*

If the eccentric-rods do not line up with the valve-rod in full gear as in Fig. 6, then, in order to get the desired length of valve stroke, allowances will have to be made in the eccentric throws. Also, the advance angles of the eccentrics will be slightly different in these circumstances, and, altogether, the problem of working out the correct length of stroke and full-gear valve timing has become rather complicated. The moral is obvious: ensure that the reversing link design will permit the in-line feature in Fig. 5. When this is so, the forward eccentric will lead the crank by 120 deg. and the reverse eccentric will lag the crank by the same angle.

With a Walschaerts gear, a definite allowance for motion lost in the link must be made. But we must first know something about the resultant motion due to the eccentric or return-crank and the combination lever. For practical purposes we may say that each sets up a harmonic motion and, when the eccentric or return-crank lags the main crank by 90 deg., as is usual, then there is a phase difference of 90 deg. between the two motions, for the combination lever motion either lags the main crank by 180 deg. or moves in step with it, according to the position of the fulcrum.

In Fig. 7, *OA* represents the crank and *OE* is the *effective* movement imparted by the return crank to the radius-rod. *OC* is the movement of the valve-rod imparted by the combination lever. It differs 180 deg. from the crank, for it is assumed that the pivot of the valve-spindle is on the opposite side of the fulcrum to the combination lever, as is usually the case with a slide-valve Walschaerts gear. The resultant motion is given by *OD*, which is obtained by completing the parallelogram *OEDC*. Now it is required that this resultant motion shall be 120 deg. ahead of, or behind, the main crank, according to the direction of the crankshaft rotation. All we need do is to draw the horizontal line *CA* and from any point *O* draw *OD* at 60 deg. to *OC*, to a scale convenient to the full-size dimensions of the actual job, half the length of the valve stroke. When the parallelogram *OEDC* is completed, *OE* is the movement which must be imparted to the radius-rod by the link swing and *OC* is the motion which the combination lever must give on the valve spindle. The details for the combination lever easily follow. In Fig. 8 the dimension *a* is usually decided by the cylinder design. As shown, the diagram is for a slide-valve; if a piston-valve were being considered, the positions of the valve-rod and the radius-rod would be reversed. The dimension *b* must be made equal to half the piston stroke, multiplied by *a*, and divided by the actual dimension *OC* to job scale.

It remains to find what allowance must be made for the lost motion in the link. Fig. 9 makes it self-evident how this occurs. The link swings about its pivot *O* to a radius *b*, where the return-rod or the eccentric-rod is pivoted, but the radius-rod can swing only to the lesser radius *a*. Clearly, then, the eccentric or return-crank must impart a motion to the link $b/a$ times the actual distance *OE* to job scale. If then the link arrangements as in Fig. 9 are drawn to the same

*Continued from page 571, "M.E.," November 25, 1948.

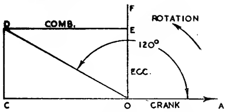



*Fig.* 7

scale as the diagram in Fig. 7, $OF$ corresponds to $b$ and $OE$ corresponds to $a$. The eccentric or the return-crank *stroke* will be twice $OF$ to the same scale.

These details will enable one to determine all the essential dimensions for a Walschaerts gear

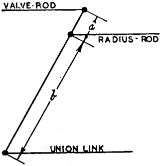



*Fig.* 8

suitable for a given piston stroke. The method, again, is not rigorous, but it is quite accurate enough for small engines, for the actual job results will be found to agree with the predictions within the limits of practical measurement.

To revert to our question, about the effect of linking-up, so far as it concerns Walschaerts gear, obviously, the effect of this operation, as is clear from Fig. 8, is to reduce the length of $OE$. In consequence, the angle $AOD$ by which the valve stroke leads the piston stroke is made greater. But the greater this angle, the earlier is the cut-off. But the effect of shortening $OE$ is also to shorten $OD$ as well, that is, the valve stroke. The net result of all this is that the steam admission-point does not alter when the gear is linked up. Cut-off occurs earlier and the expansion period is lengthened so that the steam

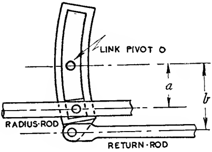



*Fig.* 9

exhausts at a lower pressure than it does when the gear is at the maximum cut-off position.

In conclusion, it is hoped that these notes will be helpful to those who desire to work out their own valve-gear details. Every effort has been made to evolve the simplest way of doing this, and, except for the very simple multiplication and division needed to work out the length of the combination lever for the Walschaerts valve gear, no calculations are necessary.

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# Petrol Engine Topics

(*Continued from page* 594)

with taper needle jet control, is fitted, and this is fabricated from components produced from bar material on capstan lathes. The contact-breaker comprises a die-cast bracket, split to clamp on the main bearing housing, and a standard form of automobile rocker arm, spring and contact screw are fitted. Some engines, however, are made without a contact-breaker, for use with glow-plug ignition.

Two standard production engines were put on test for my inspection, and while no exact observations of power or speed were made, I estimated that their performance was well up to the standard of most engines in the 10 c.c. racing class which I have so far encountered. It is, I feel, too early a stage in the production and development of these engines for anyone reasonably to expect that they should be able to break all records, but the testing and development side of the business is not neglected, and I am watching progress in this respect very carefully.

Although there have been very many people only too ready to publish the obituary notice of the miniature petrol engine, both in this country and abroad, I feel that these announcements are very premature, and that in the larger sizes of racing models, at least, this form of engine is as yet without a serious rival. It has not by any means reached the limit of its efficiency yet, and I am confident that both design and production can be, and will be, exploited to their best advantage by British manufacturers.

Meanwhile, my advice to model petrol engine enthusiasts is still the same as ever : Build your own engine if you can ; but if you decide to buy engines—buy *British* !

# Editor's Correspondence

### The "M.E." Cine-Projector

DEAR SIR,—The article by "Kinemette" on the "M.E." Cine-Projector in the November 4th issue is most interesting and constructive—but I think you are wrong in assuming,

(1) The number of people who would tackle the building of a sound projector is small—I think you will be surprised by the number who do.

(2) That components for a sound head are scarce—P.E. cells are easy, as are all components for a high gain amplifier.

Opticals—in parts or complete are in good supply from several firms.

You are right in stressing the high precision needed in a sound head—but it need not be complicated, as witness the excellent heads turned out by Southern Film Services, Slough—and the sound head on the Pathe "Vox."

One point is, however, the motors: there seems to be a sad lack of really suitable motors—what is wanted is a really efficient mains voltage synchronous motor, 1,450 r.p.m., absolutely quiet running. Can anyone put us constructors on the track of one?

Yours faithfully,
Bexleyheath. F. W. HOLMES.

### Old Model Locomotives

DEAR SIR,—I was very interested to read your "Smoke Ring" of the old 2-4-0T locomotive *L'Express* shown at the Southampton Model Engineering Society show; the name seems "to ring a bell" and I hope you will be successful in getting a photograph of her.

With regard to your query about other 70-year-olds, S.E. Railway No. 1 qualifies, I think. The photograph which Mr. Eley sent us was taken in 1875 and from further information which he recently sent me it seems very doubtful if Mr. Livesey (the owner at that time) ever actually built any models. Probably, therefore, he bought No. 1 from her builder, which, no doubt, puts the date of construction even further back.

Was she a coal-fired working model? Well, the boiler was certainly intended for coal-firing and had, in fact, had a fire in it, and soon after my brother and I bought her we got up steam (somewhat diffidently) and at 20 lb. she did work "jacked up" but only very uncertainly and jerkily, which was not surprising considering the state of affairs when we stripped her down. Nevertheless, she was built as a *working* model and it was more bad workmanship in the cylinders and valve-gear than bad design that prevented her being quite a good example.

Another example I know of was built by my father in 1878, but is now almost no more. She was a 4½-in. gauge 2-2-2 outside, constructed from castings supplied by R. A. Lee, and used to run round my father's garden at Warwick House, Stockport—the track being ½-in. sq. iron fastened to wooden sleepers by countersunk screws through the centre of the rail. He was always rather scared of the boiler and *we* were never allowed to steam her in case of accidents. Unfortunately, when he sold his workshop during the 1914-18 war the model was, by mistake, allowed to go, too. We retrieved her some years later but, alas, "only the stump of Dagon was left"—the frames, leading and driving axles and wheels, one cylinder and the boiler shell all much battered. I still have them.

Another possible veteran which qualifies is *Champion*, described in *Model Railways and Locomotives* for August, 1915, and which was at some time in Mr. Livesey's collection, as Mr. Eley included a photograph of her. She is a 2-2-2 "Fairbairn" well-tank of, I think, 15-in. gauge, and a very fine job, and was fitted with a "Giffard" injector, which dates her pretty far back.

Judging by the very complete specification, she was certainly a working model and not likely to be spirit-fired in that size! She was in Gamages in 1915 and was sold for some ridiculously low figure. I have no idea of her present whereabouts, but my letter might bring forth some information.

At a somewhat later date than you mention, there were some 2-4-0 6⅝-in. gauge tender engine models built from drawings by Horner published in *English Mechanics* for 1889-90. I bought one in 1938 and using cylinders, wheels, axles and one or two other items, built them up as a 2-4-0T, the chassis being finished except for reversing lever and drain-cock gear.

Yours faithfully,
London, W.4. N. D. WILLOUGHBY.

### Is it a Misnomer?

DEAR SIR,—I think there are various conventions used in different branches of engineering practice, and what is correct in, say, marine, may not be so in locomotive practice.

I served my time in the repair shops of the London and India Dock Co. before the P.L.A. came into being, therefore we had to repair tug and locomotive boilers and the same boilermakers had to work on both types, and they all called the furnace end of marine boilers the "front" and the firing end of locomotive boilers the "backhead."

In normal running, the firing end of a locomotive is the "backend" and the use of the word "backhead" is quite logical.

And in marine practice it is quite understandable that the end one usually looks at should be called the front.

The back of a marine boiler is always the end of the one away from the firing end.

In the case of double-ended boilers, the term "fore" and "after" ends are used, except in the case of that abomination (if coal-fired) the athwartship-fired-boiler—these, however, are rare.

While being a marine engineer of over forty years' standing (twenty-five of them as chief) I have always had a great interest in locomotives. As an apprentice, my greatest friend, whom I saw every day, worked in the G.E.R. Stratford shops and helped to build the Decapod.

Yours faithfully,
Ilford. W. F. JACOBS.